

REMARKS

This Response is intended to be fully responsive to the Final Office Action dated June 1, 2006. In view of the following discussion, the Applicants believe that all claims are presently allowable.

DRAWING OBJECTIONS

Figure 3 stands objected to as showing only prior art without being labeled as such. The Applicants respectfully disagree.

The Examiner is mistaken that Figure 3 depicts a common, commercially available CENTURA® semiconductor wafer processing system. The Applicants reassert the comments made in the previous Response filed May 23, 2006. In response to the Examiners recitation from Paragraph [0044] of the application in the Response to Arguments section of the Final Office Action, the Applicants reassert that the Examiner is mistaken.

As noted by the Examiner, the cited portion of paragraph 44 states, exactly:

[0044] FIG. 3 depicts a schematic diagram of the etch reactor 302 that illustratively may be used to practice portions of the invention. The etch reactor is generally used as a processing module of the CENTURA® semiconductor wafer processing system available from Applied Materials, Inc. of Santa Clara, California.

The Applicants note that the CENTURA® semiconductor wafer processing system is a modular processing system allowing for multiple modules (etch reactors and/or other processing chambers) to be attached to a central transfer chamber. The above-recited portion of the application notes that the etch reactor is generally used as a processing module of the CENTURA® system. The etch reactor is not the CENTURA® system itself. As noted in the application, the etch reactor 302 depicted in Figure 3 may be used in conjunction with the CENTURA® system (*i.e.*, “as a processing module of the CENTURA® semiconductor wafer processing system,” as recited in paragraph [0044] of the application). In other words, if one owned a CENTURA® system and wished to practice the present

invention, they could connect an etch reactor as described in Figure 3 to the CENTURA® system and follow the methods disclosed in the application.

Moreover, as noted in the Response filed May 23, 2006, the etch reactor 302 depicted in Figure 3 includes a controller 340, having the inventive method stored therein as a software routine 304. (See, *Application*, [0052]-[0053].) Accordingly, the etch reactor depicted in Figure 3 is not a common, commercially available prior art etch reactor, as asserted by the Examiner. Thus, Figure 3 should not be labeled "Prior Art," as requested by the Examiner.

Thus, the Applicants submit that Figure 3 is proper. Accordingly, the Applicants respectfully request that the objection be withdrawn.

CLAIM REJECTIONS

A. Claims 1-6, 8-10 and 40-45

Claims 1-6, 8-10 and 40-45 presently stand rejected as being unpatentable over United States Patent No. 6,797,633, issued September 28, 2004, to *Jiang, et al.* (hereinafter *Jiang*) in view of United States Patent Application Publication Serial No. 2004/0161930, published August 19, 2004 to *Ma, et al.* (hereinafter *Ma*), and/or United States Patent No. 6,797,633, issued July 30, 2002 to *Ikeda* (hereinafter *Ikeda*). The Applicants respectfully disagree.

The Applicants re-assert and respectfully request reconsideration of the previously provided argument in the Response submitted May 23, 2006 in view of the additional comments provided below.

The Applicants note the following in response to the Examiner's comments in the Response to Arguments section of the Final Office Action:

With respect to paragraph 7 – regarding the relevance of the discharge sequence of *Ma* – the Applicants contend that *Ma*'s teaching that no etching of the photoresist layer or substrate occurs during the discharge sequence, (*Ma*, paragraph [0028]), is relevant to the resultant combination yielded upon combining the teachings of *Ma* with *Jiang* and *Ikeda* in order "to avoid arcing during plasma etch processes," as provided by the Examiner. (see, *Final Office Action*, p. 5, ll. 2-4.)

Specifically, *Ma* teaches that to avoid arcing during a plasma etch process, a discharge sequence is performed prior to the etch process. *Ma* fails to teach or suggest the limitations asserted by the Examiner in order to eliminate or reduce the incidence of arcing while etching. Therefore, because no etching of the photoresist layer or substrate occurs during the discharge sequence, any combination of *Ma* with *Jiang* (and *Ikeda*) for the purpose of reducing arcing during etching results in a method wherein the discharge step (*that does not etch the substrate*) is performed *prior to* plasma etching. Thus, the teachings of *Ma* in combination with *Jiang* and *Ikeda* fail to yield the limitations recited in claims 1 and 40.

In paragraph 9 of the Final Office Action, the Examiner acknowledges that "obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art." The Examiner then asserts that it would have been obvious to combine *Jiang*, *Ma*, and *Ikeda* "to avoid arcing during plasma etch processes and to reduce the F radicals which form a hardened surface layer...."

The Applicants submit that the motivation provided by the Examiner to combine the cited references will not yield a process having the limitations presently claimed. Specifically, as noted above and in the previous Response filed May 23, 2006, the motivation provided by the Examiner to combine the teachings of *Ma* ("to avoid arcing during plasma etch processes"), will yield an in-situ discharge step (during which *Ma* specifically states that no etching occurs) performed prior to etching in order to avoid arcing during the plasma etch process subsequently performed. Thus, *Ma* fails to teach or suggest the modification of *Jiang* proposed by the Examiner.

With respect to the motivation provided by the Examiner to combine the teachings of *Ikeda* ("to reduce the F radicals which form a hardened surface layer"), the Applicants note that *Ikeda* fails to provide any teaching whatsoever

that the process conditions proposed to be combined with *Jiang* and *Ma* by the Examiner provides the benefit recited by the Examiner.

Specifically, to provide the benefit that the Examiner cites (*i.e.*, "to reduce F radicals which form a hardened surface layer"), *Ikeda* teaches that, in a parallel plate plasma etcher, "the upper electrode 703 is made of Si, which has high reactivity for F radicals. That is, the excessively generated F radicals are trapped by Si of the upper electrode so that F radicals are reduced." (*Ikeda*, col. 2, ll. 40-44.) Therefore, to utilize the motivation provided by the Examiner, to reduce F radicals, one would provide an etch reactor having an upper electrode made of Si. *Ikeda* fails to teach or suggest that the process conditions cited by the Examiner have any affect whatsoever on the reduction of F radicals.

In addition, *Ikeda* teaches that sputtered Si from the upper electrode may deposit on the photoresist and form a hardened resist surface layer. *Ikeda* further teaches that the electricity to the upper electrode should be removed – *i.e.*, the upper electrode should be grounded – to cause a reduction in excess Si atoms which prevents the hardened surface layer from being formed on the photoresist. (*Id.*, col. 5, ll. 61-67.) Therefore, if one wished to prevent the hardened surface layer from being formed on the photoresist, the upper electrode should be grounded. Therefore, to obtain the benefit of the motivation provided by the Examiner, *Ikeda* further teaches to ground the upper electrode. Thus, *Ikeda* teaches away from the modification proposed by the Examiner.

The Examiner further asserts in paragraph 9 (and again in paragraph 11) of the Final Office Action that the Applicants have found "a different mechanism to reduce F radicals." However, the Applicants note that, after careful review of *Ikeda*, the Applicants can find no support whatsoever for the contention that the teachings of *Ikeda* that the Examiner proposes to combine with *Jiang* and *Ma* provide the benefit that the Examiner asserts. *Ikeda* simply fails to provide any suggestion or motivation to modify the etch process as taught by *Jiang* (alone or as modified by *Ma*) in a manner that yields the limitations recited in claims 1 and 40.

The Examiner further asserts in paragraph 9 of the Final Office Action the pointed to teaching of *Ikeda* "does not negate the provided step II (e.g.) in *Ikeda's* Fig. 4." However, the Applicants respectfully note that, as acknowledged by the Examiner, there must be "some teaching, suggestion, or motivation to [make the proposed modification] found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art." Here, as noted above and in the Response filed May 23, 2006, the cited references fail to provide any motivation to make the proposed combination because *Ikeda* fails to teach or suggest that providing a plasma source power of at least about 1000 Watts and a bias power of at least about 800 Watts, as recited in claims 1 and 40, will reduce F radicals in the process chamber. The motivation provided by the Examiner to combine the cited references clearly results in a different process than that recited in the present claims. Thus, the combination *Jiang*, *Ma*, and *Ikeda* fails to yield the limitations recited in the claims as required to establish a *prima facie* case of obviousness.

In summary, it is respectfully submitted that the Examiner has not pointed to any objective teaching in *Ikeda* or *Ma* that would lead an individual to combine the relevant teachings of the references. Therefore, a *prima facie* case of obviousness has not been established because any permissible combination of the cited references fails to yield all of the limitations recited in each of independent claims 1 and 40, and all claims respectively depending therefrom. Specifically, the combination of the cited references fail to teach or suggest a plasma source power of at least about 1,000 Watts and a bias power of at least about 800 Watts during at least a portion of the etch step, as recited in claims 1 and 40.

Thus, independent claims 1 and 40, and claims 2-6, 8-10 and 41-45, respectively depending therefrom, are patentable over *Jiang* in view of *Ma* and/or *Ikeda*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

B. Claims 7, 11-17 and 44-45

Claims 7, 11-17 and 44-45 stand rejected as being unpatentable over *Jiang* in view of *Ma* and/or *Ikeda*, as applied to claims 1-6, 8-10, and 40-45 above, and further in view of Taiwan Patent 544,815 published August 1, 2003 to *Chun, et al.* (hereinafter *Chun*), and United States Patent 6,177,147 issued on January 23, 2001 to *Samukawa, et al.* (hereinafter *Samukawa*). The Applicants respectfully disagree.

Independent claims 1 and 40, from which the rejected claims depend, recite limitations not taught or suggested by any combination of the cited art. The patentability of claims 1 and 40 over *Jiang* in view of *Ma* and/or *Ikeda* have been discussed above. *Chun* discloses a process for etching a nitride layer and an oxide layer using O₂, N₂, and CF₄ in a ratio of O₂:N₂:CF₄ equal to 4-50:0-10:1. *Chun* further discloses applying an RF power in the range of 100 to 1000 Watts but is silent regarding any bias power applied. (*Chun*, Abstract.) However, *Chun* fails to teach or suggest a plasma source power of at least about 1,000 W and a bias power of at least about 800 W during at least a portion of the etch step, as recited in claims 1 and 40. As such, *Chun* fails to teach or suggest a modification of any combination of *Jiang*, *Ma*, and *Ikeda* that would yield the limitations recited in the claims.

Samukawa discloses a process and apparatus for treating a substrate using an ultra-high frequency (UHF) plasma. *Samukawa* further generally discloses applying a UHF RF power in the range of 0 to 1000 Watts but is silent regarding the bias power applied. (*Samukawa*, Figs 3, 6-8, and accompanying text.) However, *Samukawa* similarly fails to teach or suggest a plasma source power of at least about 1,000 W and a bias power of at least about 800 W during at least a portion of the etch step, as recited in claims 1 and 40. As such, *Samukawa* fails to teach or suggest a modification of any combination of *Jiang*, *Ma*, *Ikeda*, and *Chun* that would yield the limitations recited in the claims.

Therefore, a *prima facie* case of obviousness has not been established because any permissible combination of the cited references fails to yield all of

the limitations recited in each of independent claims 1 and 40, and claims 7, 11-17, and 44-45, respectively depending therefrom.

Thus, independent claims 1 and 40, and claims 7, 11-17, and 44-45, respectively depending therefrom, are patentable over *Jiang* in view of *Ma* and/or *Ikeda*, and further in view of *Chun*, and *Samukawa*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

CONCLUSION

Thus, the Applicants submit that all claims now pending are in condition for allowance. Accordingly, both reconsideration of this application and its swift passage to issuance are earnestly solicited.

If the Examiner believes that any unresolved issues still exist, it is requested that the Examiner telephone Mr. Alan Taboada at (732) 935-7100 so that appropriate arrangements can be made for resolving such issues as expeditiously as possible.

Respectfully submitted,

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Date

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